Program: B. Tech– Data Science				Semester: VI	
Course/Module : Big Data				Module Code: BTDS06001	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks -50)	Term End Examinations (TEE) (Marks -70 in Question Paper)
3	2	0	4	Scaled to 30 marks	Scaled to 70 Marks

Pre-requisite: R/R-Studio/SAS/Tableau programming

Objectives:

Big data Analytics refers to skills, practices and techniques used in converting large scale data and its storage about computation challenges to convert data into information and knowledge that aid making business decision. This discipline consists of an understanding of:

- Distributed storage and computation and usage of concept like Map Reduce, developed and widely used by Google search engine
- The use of the above analysis and visualization to aid decision making

Outcomes:

After completion of the course, students would be able to :

- Upon completion of this course one will be able to setup, manage and exploit big data cluster for analytics from social media. This will make student ready to setup and manage environment of cluster, cloud, grid and stream computing.
- One will be able to setup Hadoop or Casendra cluster for handling big data and distributed file system and computing. Helps work on large scale systems and social media systems.
- One will be able to provide cyber security as an expert to high net asset systems with critical data

Detailed Syllabus: (per session plan)

1	Introduction to Big Data	03
2	Big Data	03
	• What is Big data	
	• How do to process big volume data	03
	• Setup Hadoop and / or Casendra	
	• Map Reduce	03
	• Ranking algorithm	
	• Community detection cluster (application of clustering)	03
3	• Data Visualization in Big Data	03
	• Social Media mining	
	• Introduction to text data mining	03

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	• Basic concepts in text retrieval • Information retrieval models • Implementation of a search engine • Evaluation of search engines • Advanced search engine technologies • Stream data analytics	
4	Pig, Hive, MongoDB, Spark	24
	Total	**45**

Text Books:
1. An Introduction to Statistical learning with application in R. by Trevor Hastie, Robert Tibshirani (2013). Publisher/Edition: Springer Science + Business Media New York.
2. SAS E-Minor reference Manual

Reference Books:
3. An Introduction to Categorical Data Analysis Second Edition, Wiley-inter-science, A John Wiley & sons, INC, Publication
4. The Element of Statistical Learning, Data mining, Inference and Prediction by Trevor Hastie, Robert Tibshirani, Jerome Friedman, Publication: Springer Series in Statistics

Any other information: NIL

Details of Internal Continuous Assessment (ICA):
Test Marks: 20
Term Work Marks: 30

Details of Term work:
1. Practical based on 10 Experiments
2. Two class tests.
3. Minimum two assignments

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Program:	B. Tech Data Science		Semester: VI	
Course/Module: Deep Learning			Module Code : BTDS06002	
Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks -50)**	**Term End Examinations (TEE) (Marks -70 in Question Paper)**
3	2	0	4	Scaled to 30 marks	Scaled to 70 Marks

Pre-requisite: Machine Learning and Data Mining

Objectives: Expand the knowledge gained in Database Management Systems in several directions like Non-Relational data models, deductive (Intelligent) database systems, distributed systems, web based systems and object oriented systems etc.

Course Outcomes:
After completion of the course, students would be able to:
- Design database using concept of extended entity relationship model.
- Implement functions and procedures using concepts of PL/SQL
- Implement object oriented concepts in database.
- Compare and contrast different types of advance database management systems.
- 5. Describe database Administration and its management.

Detailed Syllabus:

Unit	Description	Duration
1.	**Introduction to deep learning: Neural network basics:** Supervised Learning with Neural Networks, Computation graph, Broadcasting in Python	05
2.	**Shallow neural networks:** Computing a Neural Network's Output, Vectorizing across multiple examples, Explanation for Vectorized Implementation, Activation functions, Derivatives of activation functions, Gradient descent for Neural Networks, Back-propagation intuition, Random Initialization	05
3.	**Deep Neural Networks:** Deep L-layer neural network, Forward Propagation in a Deep Network, Getting your matrix dimensions right, Building blocks of deep neural networks, Forward and Backward Propagation, Parameters verses Hyper parameters	05
4.	**Improving Deep Neural Networks: Hyper parameter tuning, Regularization and Optimization: Practical aspects of Deep Learning:** Initialization, Regularization, Gradient Checking	03

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5.	Optimization algorithms: Mini-batch gradient descent, Understanding mini-batch gradient descent, exponentially weighted averages, Understanding exponentially weighted averages, bias correction in exponentially weighted averages, Gradient descent with momentum	**05**
6.	Hyperparameter tuning, Batch Normalization and Programming Frameworks	**05**
7.	Convolutional Neural Networks: Foundations of Convolutional Neural, Deep convolutional models: case studies, Object detection, Special applications: Face recognition & Neural style transfer	**05**
8.	Sequence Models: Recurrent Neural Networks **Data Flow programming: TensorFlow**	**03** **9**
	Total	**45**

Text Books:
1. Deep Learning by Ian Goodfellow, Yoshua Bengio, Aaron Courville
2. Deep Learning Hardcover – 3 Jan 2017 by Ian Goodfellow, Yoshua Bengio, Aaron Courville, Francis Bach

Reference Books:
1. Deep Learning - 3 Jan 2017 by Ian Goodfellow, Yoshua Bengio, Aaron Courville, Francis Bach
2. Deep Learning, Vol. 2: From Basics to Practice by Andrew Glassner

Any other information: NIL

Details of Internal Continuous Assessment (ICA):
Test Marks: 20
Term Work Marks: 30

Details of Term work:
- Minimum two Assignments.
- 3. Two class tests.

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Program: B. Tech Data Science				Semester: VI	
Course/Module: Computer Vision				Module Code: BTDS06003	
Teaching Scheme			Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks -50)	Term End Examinations (TEE) (Marks -70 in Question Paper)
3	2	0	4	Scaled to 30 marks	Scaled to 70 Marks

Pre requisite: Nil

Objectives:

Computer Vision focuses on the development of algorithms and techniques to analyse and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis, visual geometric modelling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Outcomes:

After completion of the course, students would be able to:
- The theoretical and practical aspects of computing with images
- Understand the geometric relationship between 2D images and the 3D world.

Detailed Syllabus: (Per Session Plan)

Unit	Description	Duration
1	Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.	06
2	Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel	05
3	Feature Extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.	08

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4	Image Segmentation:Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.	**06**
5	Pattern Analysis : Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.	**08**
6	Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.	**07**
7	Shape from X :Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.	**05**
	Total	**45** hours

Text Books:
1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

Reference Books
1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004
2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

Any other information: NIL

Details of Internal Continuous Assessment (ICA):
Test Marks: 20
Term Work Marks: 30

Details of Term work:
• Practical based on 10 Experiments
• Two class tests.
• Minimum two assignments

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Program: B. Tech Data Science				Semester: VI	
Course/Module : Predictive Modelling				Module Code: BTDS06004	
Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks -50)	Term End Examinations (TEE) (Marks --)
3	0	0	3	Marks Scaled to 50	---

Pre-requisite: Basic Computer Knowledge

Objectives:
- To learn basics of statistics including logistic regression
- To learn data mining including predictive modeling and pattern recognition

Outcomes:

After completion of the course, students would be able to:
- Apply statistical analysis to wide range of problems
- Use data mining to solve practical problems

Detailed Syllabus:

Unit	Description	Duration
1	**Getting Started with Tool**: Introducing to the Enterprise Guide 7. 1 environment.	02
2	**Introduction to Statistics**: discussing fundamental statistical concepts, examining distributions, describing categorical data, constructing confidence intervals, performing simple tests of hypothesis	04
3	**Analysis of Variance (ANOVA)** : performing one-may ANOVA, performing multiple comparisons, performing two-way ANOVA with and without interactions.	04
4	**Regression**: using exploratory data analysis, producing correlations , fitting a simple linear regression model, understanding the concepts of multiple regression, building and interpreting models, describing all regression techniques, exploring stepwise selection techniques.	04
5	**Regression Diagnostics** : examining residuals, investigating influential observations and collinearity.	06
6	**Categorical Data Analysis**: describing categorical data, examining tests for general and linear association, understanding the concepts of logistic regression and multiple logistic regression, performing backward elimination with logistic regression	06
7	**Introduction** : Introduction to the tools	01
8	**Accessing and Assaying Prepared Data**: creating project, library, and diagram, defining a data source, exploring a data source.	01
9	**Introduction to Predictive Modeling with Decision Trees**:	04

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	cultivating decision trees, optimizing the complexity of decision trees, understanding additional diagnostic tools (self-study), autonomous tree growth options (self-study)	
10	**Introduction to Predictive Modeling with Regressions**: selecting regression inputs, optimizing regression complexity, interpreting regression models, transforming inputs, categorical inputs, polynomial regressions (self-study)	04
11	**Introduction to Predictive Modeling with Neural Networks and Other Modeling Tools:** introduction to neural network models, input selection, stopped training ,other modeling tools (self-study)	04
12	**Model Assessment**: model fit statistics, statistical graphics, adjusting for separate sampling, profit matrices	01
13	**Model Implementation**: internally scored data set, score code Modules	01
14	**Introduction to Pattern Discovery** : cluster analysis, market basket analysis (self- study)	03
15	**Special Topics**: ensemble models, variable selection, categorical input consolidation ,surrogate models	02
	Total	45

Text Books:
1. "Machine Learning, A probabilistic perspective", Kevin P Murphy, IGHT Press Aug 2012.

Reference Books:

1. Olivia Parr-Rud, Business Analytics Using Enterprise Guide and Enterprise Miner: A beginner's Guide, Oct 2014
2. Kattamuri S, Sarma, Predictive Modeling with & Enterprise MinerT": Practical Solutions for Business Applications, Second Edition
3. ANOVA, Regression and Multiple Regression (Standard Course Material)
4. Applied Analytics using e-miner (Standard Course Material)
5.

Any other information: NIL

Details of Internal Continuous Assessment (ICA):
Test Marks: 20
Term Work Marks: 30

Details of Term work:
Case Studies / Assignments / Class Test/Presentation/Project

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Program:		**B. Tech Data Science**			Semester: VI	
Course/Module: Natural Language Processing					**Module Code :BTDS06005**	
Teaching Scheme					**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**		**Internal Continuous Assessment (ICA) (Marks -50)**	**Term End Examinations (TEE) (Marks -70 in Question Paper)**
3	**2**	**0**	**4**		**Scaled to 30 marks**	**Scaled to 70 Marks**

Pre-requisite: Students are required to have the following prerequisites:
- Basic probability and statistics
- Programming

Objectives:
- Understanding biology of Natural Language Processing; Place and Manner of Articulation; Word Boundary Detection; Argmax based computations;
- Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

Outcomes:
After completion of the course, students would be able to:
This course will examine the state-of-the-art in applied NLP, with an emphasis on how well the algorithms work and how they can be used (or not) in applications. Today there are many ready-to-use plug-and-play software tools for NLP algorithms. For this reason, this course will emphasize getting facile with quick programs using existing tools. The intended **learning outcomes** are for students to:
- Learn about major NLP issues and solutions
- Become agile with NLP programming
- Be able to asses NLP problems
- Be able to get the gist of relevant research papers
- Understand Natural language understanding, processing, generation.

Detailed Syllabus:

Unit	Description	Duration
1.	Introduction, Machine Learning and NLP, ArgMax Computation, Syntactic Collocations; More on Term Weighting	**05**
2.	Practice with ipython Notebooks, NLTK Text; Adopt a text collection, Tokenize Your Text Collection, Create a First Look at Your Text Collection, Parts of Speech and Tagging,	**05**

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	Part of Speech Tagging, POS Taggers, Practice Training a POS Tagger, Chunking WSD : WordNet, Wordnet; Application in Query Expansion, Wiktionary; semantic relatedness, Measures of WordNet Similarity, Similarity Measures (contd.), Resnick's work on WordNet Similarity	
3.	WordNet Lexical Relations, Work on your Keyphrase assignment, Keyphrase Identification Assignment, Run Keyphrase Extraction on Mystery Text, Names features Parsing Algorithms, Evidence for Deeper Structure; Top Down Parsing Algorithms, Noun Structure; Top Down Parsing Algorithms- contd, Non-noun Structure and Parsing Algorithms	**05**
4.	Probabilistic parsing; sequence labeling, PCFG, Probabilistic parsing; PCFG (contd.), Probabilistic parsing: Training issues Pandas Intro and Readings, Read About Syntactic and Semantic Parsing Review, Parsing, and Logic, Kaggle-based Text Classification Assignment	**05**
5.	Arguments and Adjuncts, Probabilistic parsing; inside-outside probabilities Text Clustering, Distributional Semantics readings, Clustering and Distributional Semantics	**04**
6.	Morphology, Graphical Models for Sequence Labelling in NLP, Graphical Models for Sequence Labelling in NLP (contd.)	**03**
7.	Phonetics, Consonants (place and manner of articulation) and Vowels Vowels (contd.), Forward Backward probability; Viterbi Algorithm	**03**
8.	Phonology, Sentiment Analysis and Opinions on the Web, Machine Translation and MT Tools - GIZA++ and Moses.	**03**
9.	Text Entailment, POS Tagging., Phonology; ASR	**03**
10.	HMM and Viterbi, HMM and Viterbi (contd)	**03**

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11.	Precision, Recall, F-score, Map, Semantic Relations; UNL; Towards Dependency Parsing., Universal Networking Language	03
12.	Semantic Role Extraction, Baum Welch Algorithm; HMM training, Baum Welch Algorithm; HMM training	03
	Total	45

Text Books:
1. Natural Language Processing with Python online book: http://www.nltk.org/book/
2. Speech and Language Processing, 2nd Edition 2nd Edition by Daniel Jurafsky, James H. Martin

Reference Books:
1. Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit 1st Edition by Steven Bird, Ewan Klein, Edward Loper
2. Applied Text Analysis with Python: Enabling Language-Aware Data Products with Machine Learning 1st Edition by Benjamin Bengfort, Rebecca Bilbro, Tony Ojeda
3. Natural Language Processing and Computational Linguistics: A practical guide to text analysis with Python, Gensim, spaCy, and Keras Paperback – June 29, 2018 by Bhargav Srivinasa-Desikan

Any other information: NIL

Details of Internal Continuous Assessment (ICA):
Test Marks: 20
Term Work Marks: 30

Details of Term work:
As per Internal Continuous Assessment (ICA) norms of the institute
• Minimum two Assignments.
• Two class tests.

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Program: B. Tech Data Science				Semester: VI	
Course/Module: Financial Institution and Market				Module Code: BTDS06006	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Internal Continuous Assessment (ICA) (Marks -50)**	**Term End Examinations (TEE) (Marks -70 in Question Paper)**
3	0	0	3	Scaled to 30 marks	Scaled to 70 Marks

Pre-requisite:
- Macroeconomics
- Financial Management

Objectives:
- To provide the participants with an exposure and thorough understanding of the Indian Financial systems and its components.
- Understand the concept and characteristics of Leasing, Hire purchase Factoring and Forfeiting.

Outcomes:
After completion of the course, students would be able to:
- Student will be able to understand about the financial system of our Economy

Detailed Syllabus:

Unit	Description	Duration
1	Indian Financial System, International Financial System. Impact of Liberalization on Financial Institutions and Markets	03
2	**Financial Regulators**: Reserve Bank of India, Security Exchange Board of India, Insurance Regulatory Development Authority. Role of Other institution like- Association of Mutual Funds of India, Pension Fund Regulatory And Development Authority, National Housing Bank & AMBI (Association of Merchant Bankers of India)	04
3	**Financial Institutions:** Development Financial Institutions Banking and Non- Banking Financial Institutions	04
4	**Rural Banking and Micro financing**: Micro Finance Institution, Role of Non -governmental Organization in micro financing, Formation and types of Self Help Group. Models of Micro financing (Bandhan, Grameen Bank, Swayam Krishi Sangam Micro finance etc.)	04

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5	**Financial Markets**: Capital and Money, Debt and Equity, Primary and Secondary, Role of Markets, Anomalies, Bubbles etc.	**07**
6	**Financial Instruments**: Equity, Debts & Derivatives: Plain Vanilla to exotic, risk-hedging instruments.	**03**
7	**Financial Service**: Fund-based and Fee based services	**03**
8	**Introduction to equipment Leasing:** Introduction, Types, Advantage and Disadvantage of leasing, Lease Evaluation	**04**
9	**Hire Purchase**: Concept and characteristics of Hire purchase, Mathematics of Hire purchase.	**05**
10	**Factoring and Forfaiting:** Concept of Factoring, Forms of Factoring, functions of Factor, Factoring vs Forfaiting	**04**
11	**Introduction to consumer Finance**: Credit Cards. Credit Rating, Securitization, mortgage and mortgage instruments. Private Placements, Private Equity, Venture Capital, Buyback and De-listing	**04**
	Total	**45**

Text Books:
1. Pathak, B.V. (2012). TJie lndinn financial System, 3/e, New Delhi, Pearson.

Reference Books:
1. Madura, J. (2010). Finnncinl Institutions fi Tardis, 9/e, New Delhi, Cengage Learning.
2. Kohn, M. (2013). F-mineral Jns)ifufions O Markets, 2/e, New Delhi,Tata Mc-Graw Hill.
3. Khan, M.Y. (2009). litdioii financial SiJstem, 6/e, New Delhi, Tata Mc-Are w Hill.
4. Bhole, L.M. (2009). F-innncinl Institutions nod Markets, 5/e, New Delhi, Tata McGraw Hill.

Any other information: NIL

Details of Internal Continuous Assessment (ICA):
Test Marks: 20
Term Work Marks: 30

Details of Term work:
Class Test/ Assignment/ Case Studies/ Projects/ Presentations

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Program: B. Tech Data Science					Semester: VI	
Course/Module : Marketing Management					Module Code: BTDS06007	
Teaching Scheme				Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks -50)	Term End Examinations (TEE) (Marks -70 in Question Paper)	
2	0	0	2	Scaled to 30 marks	Scaled to 70 Marks	

Pre-requisite: Nil

Objectives:

- Understand Marketing Concepts and Orientation.

- Understand various marketing models for solving marketing problems.

- Apply the marketing principles to develop a market plan.

Outcomes:

After completion of the course, students would be able to:

- To develop a marketing plan based on knowledge of marketing principles and framework

Detailed Syllabus:

Unit	Description	Duration
1	Introduction to Marketing: Concepts, and Orientations.	03
2	Marketing Strategy	03
3	Building Customer Value, Satisfaction and Loyalty, CLV, Relationship marketing, Database marketing	03
4	Segmenting, Targeting and Positioning	03
5	Competitive Strategies for Market Leaders, Challengers and Niches, Product Life Cycle Strategy	03
6	Setting Product strategy: Characteristics and classifications, Product mix pricing. New Product Development Process	03
7	Definitions and key concepts related to : Consumer Decision Process, Brand Equity, Integrated Marketing Communications, Definition and Distinctive characteristics of Services Business and Decisions related to Global Entry strategies	03
8	Designing and Managing Integrated Marketing Channels.	04

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9	Developing Pricing Strategies and programs	02
10	Designing and Managing the Sales Force and Principles of Personnel Selling.	03
	Total	30

Text Books:
1. Kotler, P., Keller, Koshy, Jha. (2013). MnrRfixg Mniingemetif; 14/ e, New Delhi: Pearson Education

Reference Books:
2. Saxena, R. (2009). Marketing Management; 5/e, New Delhi: Tata McGraw Hill.

Any other information: NIL

Details of Internal Continuous Assessment (ICA):
Test Marks: 20
Term Work Marks: 30

Details of Term work:

Class Test/ Assignment/Case Studies/ Projects/ Presentations

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